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ABSTRACT

Although the report is specifically about Argentina, Uruguay and Paraguay, the considerations presented are valid for all of Latin America. In September, 1969, Argentina had approximately 200 electronic computers. The annual growth is estimated at 15-20% and the implementation of teleprocessing and time-sharing systems have made evident the shortage of personnel. Most of the requirements are being met by ad-hoc courses, held by computer companies. In Uruguay, approximately 20 electronic computers are presently working. There are about 100 students registered in the Computing Science Career curriculum. Paraguay does not, as yet, have a computer, however, a Computer Center has been created with courses in Numerical Analysis, Programming, Operational Research, etc. The shortage of Computer Science teachers makes the multiplication of educational centers impossible. The United Nations could stimulate and aid the installation of Regional Centers of intensive education to train selected students in a short time. Since Spanish is spoken by most Latin American (and understood by Brasilians) the programming of such a project is much easier. (Author/NH)

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COMPUTING AND EDUCATION

IN

ARGENTINA, URUGUAY AND PARAGUAY

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Buenos Aires

September 1969

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REPORT: Computing and Education in Argentina, Uruguay and Paraguay

I. - Present situation

We will refer to Argentina, Uruguay and Paraguay because of our personal experience is in these countries. Nevertheless, our knowledge of Latin America makes us believe that the following considerations are valid for the whole region.

I. 1.-

At the present time -September 1969- there are in Argentina approximately 200 electronic computers. The largest belongs to Y.P.F. (National Petroleum Company), and is a GE-BULL 625 model. There are several IBM 360 computers, and two IBM/360, mod. 50 are ready to be installed, one at the State University of La Plata, and the other at the Hospital of the University of Buenos Aires, School of Medicine.

There are many computers (IBM;BULL-GE,Bourroughs,National,Olivetti) in big companies in the following industries:Electricity,Telephones,Gas, Banks,etc. covering the requirements of the 7 million population urban conglomerate of Buenos Aires. Computers have been installed at the State Universities of Buenos Aires, La Plata, Litoral, Cuyo and Tucumán, at the Technological University and at the Catholic Universities of Buenos Aires and Córdoba. These installations at the Universities carry on three types of activities:educational, research and service.

The pionneer work, in the Universitary sphere, was done by the Computer Center of the University of Buenos Aires, founded in 1961, with a Mercury - Ferranti computer installed the same year. This Center -in spite of the limitations of the computer and with a personnel of 50 full-time professors and graduate associates- was able to perform, between 1961 and 1966, important jobs, such as: an economic model for Argentina (by a simulation method) the determination of the orbit of Halley's comet in cooperation with the International Astronomic Union; a model for the optimum utilization ofhydraulic resources of the Cuyo's region, and other similar jobs in the fields of physics, chemistry, structural engineering, etc.

A compilation specially adapted to the lenguage requirements of the economic models group was also performed.

The installation at The Computer Center of a Mercury Ferranti Computer not backed by an adequate maintenance service led to assembling a group of electronic engineers which not only perfected but made it operational but also developed certain projects, and constructed conversors for transferring information from paper tape to cards and from analogic to digital data.

Connected with this Computer Center, the first University Academic program ("career") of Computer Science was created in 1963. The degree granted approximately a Bachelor's, and the curricular time is 3 1/2 years; the curriculum includes basic calculus courses (level of Apostol's Calculus and Mathematical Analysis), Algebra (level of Birkhoff-Mac Lane), Numerical Calculus (level of Ralston,Henrici), Probability and Statistics (level of Cramer,Feller I) and Operations Research (level of Millier-Lieberman), In addition there are special courses on Programming, Data Processing Systems, Systems Analysis, and several optative courses. Since the beginning, this career appealed to students from different schools: Mathematics,Physics,Engineering,Economics,Administration,etc. More than 200 students were registered this year, 1969, in the first year of Computer Science, after taking the entrance examination of the School of Exact Science. Similar careers are held at the CAECE (Center for Higher Studies in Exact Science), the private technological school of Buenos Aires, and at the Department of Mathematics of the University of La Plata. A special mention should be given to the recently created Computer Center of the ORT School, private technical high school (branch of World Union ORT) which has an IBM 1130 Computer, with a 1627-1 CALCOMP graphical plotter. The experience of this Computer Center is important because it is the only one at an intermediate level, and can give the basis for the creation of other similar schools, which are very much needed.

The computers already installed, the annual growth estimated at 15/20% and the implementation of teleprocessing and time-sharing systems (Bull-GE,IBM), have made evident the shortage of personnel at different levels: Operation,Programming and Systems Analysis (especially in System Analysis). Most of the requirements are being covered by ad-hoc courses, held by computer companies, but these courses have limitations, to which we will refer below.

The constant demand of personnel, which can be appreciated through advertisings in papers and magazines, and the prospect of obtaining good salaries have lead many students (who cannot enter the University or other centers of higher learning) to private institutions, most of which do not have a staff which may insure a good training. The level of the degrees granted by these institutions should be duly controlled by the corresponding authorities. This does not happen, unfortunately, at present.

In the computing field the incorporation of the graduates from the University School of Computer Science has not been adequately recognized. Graduates in Computer Science tend to emigrate, creating a serious national problem.

I.2.-

Approximately 20 electronic computers are presently working in Uruguay. The State University (Universidad de la República) has its own IBM 360/44 computer, with a memory of 128 K, installed at its Computer Center after January 1969. The other computers (IBM, BULL-GE and National) are installed in banks and industrial companies.

Capitalizing on the country's good tradition in Mathematics and Statistics, the Computer Center of the University has already performed important works in census and simulation models.

There is Computing Science career with a curriculum similar to that of Buenos Aires. There are at present approximately 100 students registered. Besides, there are special computing courses for University students in Engineering, Economics, Administration, etc.

I.3. -

No computer has been installed yet in Paraguay. Nevertheless, thanks to the pioneer spirit of several Paraguayan young people, a Computer Center has been created, with courses on Numerical Analysis, Programming, Operational Research, etc. Some of these young people have obtained their training in England, Italy, the United States, Mexico, Argentina and Chile.

Nothing can be more indicative of under-development than the existence of this situation.

II. General and Specialized Education

When the problem is the education of young people, in all levels and in all specialized fields there is a fundamental fact that cannot be ignored: we must seek the harmonic development of the intellectual, moral and physical qualities to build well pounded men possesing furthermore,particular skills.

Undoubtedly this is a general problem, but it acquires a particular importance in the case of the training of personnel for the operation of computers. The importance is still greater if the training must be done in an under- developed country. In fact, there is such sophistication in the technique used in the building computers and in programming, that the impression may be that the user's work is reduced to push a certain number of buttons to put a certain number of devices in operation. On the contrary, the really important problem is that the personnel engaged in the computing process -and each operator in his level- must know "what is the matter", the "state of the art" and the prospectives for the future.Thus even if the results are modest, it will be possible to stimulate the creative spirit as well as the possibilities for research and development in the hardware, software and in the formulation of problems to be solved.

Such an education can only be carried on by Universities or schools where the specific goal must not be limited to the use of certain models or languages, excluding those of competitors. When we say that, in under-developed countries, the problem is particularly serious, we refer to the fact that in these countries the initiative for computing development was taken by the Computers companies, while the Universities were one more customer for them. On the contrary in developed countries, the initial impulse was given by the research of theoreticians such as von Neumann and Turing, or engineers such as Aiken , Eckert,Mauchly,Wilkes and Williams, at the Institutes of Harvard, Princeton, Cambridge and Manchester.

When a computer is installed in an under-developed country, it immediately creates a false illusion of modernization. Nevertheless, this process may imply a certain modernization which can be measured by the active participation of locally based scientists and technicians. Without this participation the only result is a reflected progress which does not deeply modify the underlying reality. Therefore the local scientists and technicians must have an integral

preparation, and a specific concern for the problems of their region, which would enable them to use their knowledge in the solution of the problems set up by any type of development with adequate methods. This training can only be given by an educational institution such as the University, with interests trascending those of mere specialization.

Besides, it must be specially recognized in our countries that there is a shortage of Computer Science teachers capable of offering a high level computing education (particularly in the branches more directly related to Advanced Programming, System Analysis, Simulation Language, Information Retrieval, etc.). Therefore the multiplication of educational centers must be avoided before developing with the necessary teaching staff. It is important to remember that in these specializations it is difficult to depend on the backing of foreign experts. An intelligent initiative of the United Nations could be, for instance, to stimulate and aid the installation of Regional Centers of intensive education, where carefully selected students, at the same level, would be trained in a short time, in the most appropriate techniques. In this sense, the fact that Spanish is spoken by practically all Latin Americans (and is understood by Brasilians) makes the programming of such a project much easier.

III. - Some specific problems of under not-developed countries

The causes of under-development are political and economical, and its analysis exceeds the limits of this report.

The educational aspects of under-development are, generally, the effect of those causes, and not visa versa.

Therefore, all illusions of filling the gap between developed and under - developed countries by the building of schools or the implementation of electronic equipments for Calculus and Data Processing must be excluded. Anyway, it is important to analyze the incidence of computers in the life of our countries and to study the best possible strategy to obtain the greatest benefit from them.

The starting point must be the demistification of the computer, nipping in the bud all irrational ideas about the "miracles" that may be performed

by these marvellous tools of contemporary technology. No problem will be solved by the mere use of machines.

A deficient administrative organization, which delays the procedures and obstructs the checking of difficulties, is a characteristic of underdeveloped countries.

Some authorities believe that the problem may be solved by incorporating a powerful computer -and the more expensive the better- when in this way the only result is to automatize the routine, redundance and deficiency of the existing system.

The proper role of administrative managers is to insure that decisions about maintainance, modification and possible automation of the proceedings be taken following the advice of inter-disciplinary teams of operational research, working with scientific methods and appropriate techniques.

Another important point is that the responsible authorities should be warned against the "fashions", inspired in a waste making attitude, completely inappropriate for under-developed countries, which necesitate the use of the equipment in constant renovation. In these countries, it is common to find overdimensioned computers which are used only a few hours a day, five days a week, when it would be logical to use them 24 hours a day, seven days a week.

This happens because those who have the responsibility of decision in these matters are not sufficiently prepared to understand the main point of the problem, which is no less than the incorporation of the scientific method to the handling of daily problems.

The purchase of a computer when there are funds, is a question of minutes, while the training of personnel capable of using it efficiently requires many years and a considerable educational effort.

It is understable that the companies, concerned with placing their products, recouping the expenses and securing their profits, try to sell as elaborate equipments as possible; but the responsibility concerns the national authorities and, particularly, those in charge of educational activities, and it must not be delegated.

In Latin America violent changes in government are frequent which are often reflected by discontinuities in educational programs, disturbing the fullfilment of the projects for the training of specialized personnel as a logical

consequence.

To this we must add the increasing brain-draining from under-developed to developed countries for various reasons which contributes to deepenning the gap between them.

The conscience awareness of these problems and the active participation of the United Nations, to solve them could contribute to improving a situation which is highly damaging to the whole international community.

Manuel Sadosky

Buenos Aires, Setiembre 1969